SECTION C DESCRIPTION/SPECIFICATIONS/WORK STATEMENT

SECTION C

DESCRIPTION/SPECIFICATIONS/WORK STATEMENT

C.1 ORO C01 PERFORMANCE-BASED STATEMENT OF WORK ALTERNATE I (MAY 1997)

^{233}U Disposition and Building 3019A Shutdown

1.0 Introduction/Scope

The main objectives of this effort are: 1) to process and repackage the DOE inventory of ^{233}U stored in the Radiochemical Development Facility (Building 3019A) at the Oak Ridge National Laboratory (ORNL) to render it suitable for safe, long term, economical storage, including elimination of the need for criticality and safeguards and security controls, and, in the process, 2) to extract Thorium-229 (^{229}Th) for beneficial use from as much of the ^{233}U inventory as is practicable. These activities are to be performed with an emphasis on ensuring safe interim storage and operations in Building 3019A, and achieving closure of DNFSB Recommendation 97-1 at ORNL. Other objectives include removal of the ^{233}U material from Building 3019A for long term storage and placing Building 3019A in safe and stable shutdown for transfer to the DOE program for decommissioning. As part of this effort, DOE will lease its ^{229}Th for commercial beneficial use. Beneficial use of the leased isotope must support medical research and treatment, and reduce overall project costs or provide other financial benefits to the Government.

Long term storage of the ^{233}U in its current configuration represents a significant financial liability for DOE. Continued storage in Building 3019A will require major capital upgrades to retrofit critical facility systems that have deteriorated due to aging or that do not meet current standards. Storing the material in its current form requires significant annual operating expenses driven by material handling requirements and necessary controls to prevent nuclear criticality and proliferation.

2.0 Background

2.0 ^{233}U Inventory

The ORNL Building 3019A inventory of ^{233}U represents most of the available source of ^{229}Th in the Western Hemisphere. Bismuth-213 (^{213}Bi) is an isotope in the decay chain of ^{233}U/^{229}Th that is showing significant promise in the treatment of certain types of cancer. The Secretary of Energy recently announced an initiative to increase the availability of ^{229}Th to support cancer research and treatment.

The Building 3019A inventory consists of approximately 450 kilograms of ^{233}U contained in 1,400 kilograms of fissile uranium. There are approximately 40 grams of ^{229}Th contained in this inventory and available for extraction. The inventory is primarily in the form of uranium oxides but includes metals and other compounds. ^{232}U impurities are present in the ^{233}U at concentrations ranging from 1 to about 220 parts per million (ppm). The bulk of the material is contained in approximately 1,200 outer packages stored in four sets of shielded storage wells within the building.

The material is described in detail in the Detailed Can Data List, Reference Document # 1, and summarized in the following table:

Table 1: Uranium-233 in Building 3019A Storage Tube Vaults[1]

Storage can reference figure[2]	Material form	Package assembly Identification	Package configuration	No. of outer packages	^{233}U (kg)	^{232}U (ppm)	Total U (kg)	Risk category[3]
Fig. A.1	U Metal	LANL	Unique SS	2	5.89	40	6.02	Medium
Fig. A.2	U Oxide Powder	Savannah River SRO-9	Welded Al in Welded Al	6	2.98	7	3.05	Lower
Fig. A.3	U Oxide Powder	Savannah River LZB	Welded Al in Welded Al	6	2.94	4.5	2.99	Lower
Fig. A.4	U Oxide Powder	ORNL-RDF samples	Tin-plated steel over plastic or glass sample vials	1	0.12	6-10	0.12	Lower
Fig. A.5	UF_4·LiF	RCP-04	Welded Ni in Al	2	1.06	220	1.16	Medium
Fig. A.6	UF_4·LiF	RCP-04	Screw-top Al in Al	1	1.55	220	1.7	Higher
Fig. A.7	UF_4·LiF	RCP-04	SS in welded Al	1	0.31	220	0.34	Medium
Fig. A.8	U_3O_8 Monolith	CEUSP	Tin-plated steel over Welded SS	403	101.14	140	1042.59	Lower
Fig. A.8	U_3O_8 Monolith	RCP-06	Tin-plated steel over Welded SS	27	60.27	20	65.19	Lower
Fig. A.9	U_3O_8 Powder	Savannah River Aluminum (RCP-02)	Welded Al in welded Al	27	10.72	38	11.14	Lower
Fig. A.9	UO_3 Powder	Savannah River Aluminum (RCP-03)	Welded Al in welded Al	140	61.57	220	67.37	Medium
Fig. A.10	UO_2 Powder	Short oxide-product can (PZA BPL)	Tin-plated steel over plastic-bagged SS	22	15.02	6	15.36	Lower
Fig. A.10	U_3O_8 Powder	Short oxide-product can	Tin-plated steel over plastic-bagged SS	68	54.64	6.5-10	58.98	Lower
Fig. A.11	U_3O_8 Powder	Tall oxide-product can	Tin-plated steel over plastic-bagged SS	71	33.51	5.6-8.3	34.41	Lower
Fig. A.12	U Oxide	Mound	Glass within SS within	19	3.29	2-16	3.45	Lower

[1] Table includes material (the Mound material, Figure A.12), some of which has already been processed to extract ^{229}Th, but still needs to be blended for long term storage.

[2] Figure notation refers to drawings in Final Oak Ridge National Laboratory Site Assessment Report on the Storage of ^{233}U (ORNL/TM-1999/86, June 1999), Reference Document # 5.

[3] The risk category refers to a risk-based characterization of the material and packaging based on available package records. The intention of the risk-based characterization was not to assign an absolute risk factor to each group of packages, but to establish a relative risk ranking of the cans. The detailed risk-based characterization can be found in Reference Document #5.

	Powder		SS					
Fig. A.13	U_3O_8 Powder	ANL-ZP (5 Packet)	Welded Ni-plated SS packets within tin-plated steel	2	0.27	7	0.28	Lower
Fig. A.14	U_3O_8 Powder	ANL-ZPR (12 Packet)	Welded Ni-plated SS packets within tin-plated steel	101	32.94	7	33.61	Lower
Fig. A.15	U_3O_8 Powder	ANL-ZPR (16 Packet)	Welded Ni-plated SS packets within tin-plated steel	27	11.83	7	12.07	Lower
Fig. A.16	U Metal	ANL-ZPR (Metal)	Welded Ni-plated SS packets within tin-plated steel	1	0.56	5	0.57	Lower
Fig. A.17	U_3O_8 Powder	Oxide	Tin-plated steel over plastic bagged tin-plated steel	6	1.48	7-10.8	1.53	Lower
Fig. A.18	U Oxide Powder	Oxide scrap	Tin-plated steel over plastic bagged tin-plated steel	7	3.8	6-42	3.88	Lower
Fig. A.19	U Metal	RCP-20 (No. 2 & 3)	Tin-plated steel over plastic bagged tin-plated steel	2	3.99	5-42	4.06	Medium
Fig. A.19	U Metal	Metal scrap	Tin-plated steel over plastic bagged tin-plated steel	3	0.53	5-42	0.54	Lower
Fig. A.20	Ammonium Diuranate Powder	ADU scrap	Tin-plated steel over plastic bagged tin-plated steel	1	0.00	7	0.00	Lower
Fig. A.21	U Oxide Powder	Hanford HUA-2	SS in welded SS	6	0.35	8-38	0.36	Lower
Fig. A.22	U Metal	LANL AUA-84	Welded SS in welded SS	3	0.49	8	0.49	Lower
Fig. A.23	U Oxide Microspheres	ORNL-RDF Misc. samples	Plastic-bagged glass in cardboard within tin-plated steel	3	0.39	7	0.40	Lower
Fig. A.24	U Oxide Powder	ORNL-RDF archive samples	Tin-plated steel over plastic bagged sample vials	9	0.70	6-10	0.71	Lower
Fig. A.25	Ammonium Diuranate Powder	ADU Product	Tin-plated steel over plastic-bagged SS	1	0.09	7	0.10	Lower
Fig. A.26	UO_2 Powder	KZA-8	Tin-plated steel over tin-plated steel	1	0.19	2.5	0.20	Lower
Fig. A.27	U Oxide Powder	ARF-32	Tin-plated steel over SS	1	0.07	7	0.08	Lower
Fig. A.28	U_3O_8 Powder	FZA-88	Tin-plated steel over unknown	2	0.02	5	0.02	Lower
Fig. A.29	U Foil	CZA-90	Tin-plated steel over welded SS	1	0.57	5	0.58	Lower

Fig. A.30	U Metal	ARF-33 Metal	Tin-plated steel over tin-plated steel	4	1.43	7	1.46	Lower
Fig. A.31	U Oxides and U Foil	CZD-G (CZ)	Tin-plated steel over glass	1	0.09	1	0.09	Lower
Fig. A.32	U Foil	CZD-G (CX)	Tin-plated steel over plastic	1	0.01	6	0.01	Lower
Fig. A.33	U Metal	SNM-4031	Tin-plated steel over glass	1	0.03	1	0.03	Lower
Fig. A.34	U Metal Button and Plates	CZA-93 (U-233-4)	Tin-plated steel over glass	1	1.25	5	1.28	Lower
Fig. A.34	Oxides & Metal Pieces & Foil	CZA-93 (U-233-5)	Welded SS over tin-plated steel	1	1.06	42	1.08	Lower
Fig. A.35	U Metal	AUA-84 (Jar)	Welded SS over unknown	2	0.46	8	0.47	Lower
Fig. A.36	U Metal	CZA-91	Tin-plated steel over welded SS	1	0.86	42	0.88	Lower
Fig. A.37	U Metal	KZA-G1B	Welded SS in welded Ss	3	0.24	5	0.24	Lower
Fig. A.38	U Metal	SNM-9514 & LAE-03	Tin-plated steel over unknown	2	0.02	50	0.02	Lower
Fig. A.39	U Metal	LAW-40	Tin-plated steel over plastic	1	0.52	4	0.53	Lower
Fig. A.40	U Oxide Powder	PZA-126	SS in welded SS	1	0.28	1	0.28	Lower
Fig. A.41	U Oxide Powder	ARF-33 Oxide	SS in SS	2	1.21	7	1.24	Lower
Fig. A.42	U Oxide Powder	ASA-94 (233-1,2,3-74)	Tin-plated steel over plastic	3	1.43	7	1.46	Lower
Fig. A.43	U Oxide Powder	ASA-94 (233-4-74)	Tin-plated steel over tin-plated steel	1	0.24	7	0.24	Lower
Fig. A.44	UO_2 Powder	CZA-92	Welded SS in welded SS	1	2.25	5	2.29	Lower
Fig. A.45	U Oxide Powder	LZB-18	Tin-plated steel over welded SS	3	1.04	7	1.06	Lower
Fig. A.46	U Oxide Microspheres	MM-4899	Tin-plated steel over glass	1	0.13	7	0.14	Lower
Fig. A.47	UF_4 Powder	CZD-G (CY)	Tin-plated steel over glass	1	0.02	70	0.02	Lower
N/A	UF_6[4]	MSRE	Welded SS	52	37		37	
N/A	U_3O_8 Powder[5]	LLNL ZPR	Unknown	6	1.96	7	2	
N/A	Miscellaneous[4]	LLNL	Unknown	40	1.0	Varies	1.0	

[4] Only 25 MSRE traps are stored in Building 3019A as of 12/14/2000.

[5] This material is not currently stored in Building 3019A. DOE will deliver this material in accordance with a mutually agreed to schedule.

N/A	Miscellaneous[4]	LANL	Unknown	140	7.5	Varies	7.5	
Totals				1242	473.29		1433.65	

2.2 Radiochemical Development Facility (Building 3019A)

The Radiochemical Development Facility (RDF), also known as the Building 3019 Complex, consists of a main facility and several support facilities located in the north central area of the Bethel Valley site of ORNL. The RDF is a Manhattan Project-vintage complex that has since been modified extensively. Building 3019A, the main building, was originally constructed in 1943 as a chemical separations pilot plant. Building 3019A is a hazard category 2 nuclear facility. The auxiliary buildings are Building 3100 (storage vault); Buildings 3091, 3108, 3121 (off-gas filter houses); Building 3020 (off-gas stack); Building 3136 (uncontaminated mockup and storage building); and Buildings 3123, 3131, 3146 (standby power generators). The main Building 3019A shares common interior walls with two buildings that are not part of this contract. Building 3019B, the former High-Radiation-Level Analytical Facility, is attached to the west end of Building 3019A. A portion of Building 3001, the Graphite Reactor, is the ground floor under the east end of Building 3019A. Doorways between these attached building are sealed. Both Buildings 3019B and 3001 are out of service and are the responsibility of DOE. The Graphite Reactor, a National Historic Landmark, has a portion of the facility open to the public.

Building 3019A is a 30,000 square foot, irregular, three story (ground, first and second floors) structure. The building is situated on a hillside with the grade level on the north side at the first floor. On the south side, the ground level (or basement) is at grade level. At the core of the building are seven shielded processing cells positioned from east to west. Cell 1 has nominal floor dimensions of approximately 10 feet by 20 feet; Cells 2-7 each have nominal dimensions of approximately 20 feet by 20 feet. All of the cells have nominal floor-to-ceiling heights of 27 feet. Cells 6 and 7 are interconnected with no intervening shield wall. The cell walls are built of poured, reinforced concrete. The cell walls have nominal thicknesses of 5 feet except that the south walls and roof are approximately 4 feet thick. Above the processing cell is a high-bay structure with a 10-ton-capacity bridge crane. Each cell (except Cells 4 and 7) has a concrete roof hatch (approximately 9 feet by 9 feet) opening into the penthouse. Personnel access is provided to the floor of most cells by hatches and stairways located at ground level in a plenum area.

Cell 1 contains two monitored Molten Salt Reactor Experiment (MSRE) sodium flouride (NaF) traps. Cells 2 and 3 have new equipment for container inspection; however, most of Cell 3 is occupied by lead-shielded process equipment that has been taken out of service, Cell 4 is partially dedicated to a fissile storage array; personnel access to the remainder of the cell, which contains out of service processing equipment, is permanently blocked. Cells 5, 6 and 7 contain out of service radiochemical separations equipment and operable portions of the Low Level Liquid Waste System (LLLW). The LLLW System has an underground pipeline connection to the LLLW processing system which is operated by the DOE Environmental Management contractor. Cells 1-3 have been partially decontaminated, Cells 5, 6, and 7 are highly contaminated (>1,000,000 dpm/100 cm2 alpha).

Building 3019A contains four sets of top-loaded, shielded, storage tube vaults for solid containerized fissile materials. These tube vaults are accessible from the Penthouse area. One set, an array of 68 tubes (nominal 4 inch and 4.5 inch inside diameters) are installed in the former hatch of Cell 4. There are also three sets of in-wall storage tube vaults (a total of 26 vaults) located between Cells 2 and 3, Cells 3 and 4, and Cells 4 and 5. The lower ends of these vaults are sealed, and each vault is ventilated via the Vessel Off-Gas at the upper end. There are a number of security features associated with the stored materials.

Building 3019A also contains operational laboratories with gloveboxes and hoods and several areas with out of service gloveboxes. The facility contains pilot scale equipment in Room #22 previously used for ^{233}U processing. The RDF has four ventilation systems to maintain confinement and zoning of the facility. The four systems are the Vessel Off-Gas, Cell-Off Gas, Glove Box Off-Gas, and the Laboratory Off-Gas. The ventilation systems for the main building can exhaust approximately 40,000 cubic feet per minute, which passes through roughing and HEPA filters. The Vessel Off-Gas, a low-flow, high-negative system, is provided by the 3039 Stack system which is responsibility of the DOE Environmental Management contractor. The Laboratory and Cell Off-Gas systems also provide redundant ventilation to the out of service hot cells in the adjoining 3019B facility.

Utilities available to Building 3019A from ORNL include steam, potable water and fire water, electricity, plant air, storm sewer, and sanitary sewer. Building 3019B receives four services from Building 3019A: electrical power through Building 3019A distribution panels, fire water supply, routing of fire detection signals, and Laboratory Off-Gas ventilation of the hot cells.

Because of the extended history of operations, there are a number of legacy issues in the Building 3019 complex. In 1959, an explosion in the facility distributed a plutonium solution throughout and outside the facility. Most surfaces of the building, interior and exterior, use paint bonding to prevent spread of the residual alpha contamination. Most areas of the facility contain out of service contaminated equipment remaining from extensive pilot operations and special campaigns with spent nuclear fuel, plutonium, ^{233}U, thorium, and other radionuclides. An extensive health physics survey program and a multi-zone ventilation program control the potential migration of contamination. In addition to the radioactive hazards, uncoated lead shielding, lead paint, PCBs, asbestos, combustible foam insulation, and perchlorate contamination are present within the facility. Tank P-24, which is enclosed in an underground bunker south of Building 3019A, contains 15,000 liters of thorium nitrate solution contaminated with ^{233}U. The out of service sample conveyor, which crosses the roof from Building 3019A to 3019B, has been a recurring source of contamination to areas of the exterior roof. The exterior ventilation ducting requires periodic sealing to prevent leakage of radioactive contaminants. The facility produces LLLW, LLSW, mixed wastes, TSCA, and RCRA wastes in the course of routine operations and maintenance.

A detailed description of the facility is given in the Safety Analysis Report (SAR), (ORNL/CTD/3019/SAR/Revision 0), Reference Document # 2.

Building 3019A is under Defense Nuclear Facilitlies Safety Board (DNFSB) oversight. In March 1997, the DNFSB published Recommendation 97-1, Safe Storage of Uranium 233, Reference Document # 3, which raised issues regarding safe storage conditions of the ^{233}U inventory. In addition, the DNFSB issued Recommendation 2000-2, Configuration Management, Vital Safety Systems, Reference Document # 4, which raised concerns regarding the facility operations.

3.0 PERFORMANCE REQUIREMENTS

3.1 ^{233}U Processing, Packaging, and Transportation

The Contractor shall process and repackage all of the ^{233}U inventory, described in Table 1, to render the material suitable for long term safe, economical storage according to the specifications identified below. Additionally, the contractor shall extract ^{229}Th during ^{233}U processing according to the Project Management Plan. The Contractor shall process and repackage all of the ^{233}U in this inventory even if ^{229}Th is not extracted from it. The material identified as Figures A.13, A.14, A.15, and A.16, in Table 1 are being retained by DOE. Any processing of this material will be in accordance with the option in Section 3.5. The Contractor shall plan for handling and processing of the material based on the inventory description contained in Reference Document #5 and summarized in Section 3.1.1 below. The Contractor may process the material in Building 3019A according to requirements in Section 3.3, or propose an alternate, commercial facility. The Contractor is responsible for providing any additional equipment necessary to implement its processing strategy.

3.1.1 ^{233}U Inventory Description

A risk assessment was performed by ORNL to develop a conservative characterization of the expected condition of the ^{233}U material and packages based on available package records, including provision for over pressurized, externally contaminated, or failed packages. This assessment was based on the types of packages, considering the materials of construction, the number of container layers, and the chemical or physical form of the ^{233}U. The results of this assessment are documented in the Final Oak Ridge National Laboratory Site Assessment Report on the Storage of ^{233}U , (ORNL/TM-1999/86 of June 1999), Reference Document #5. This report also documents the limited available data from the containers that have been inspected. Additionally, the Safety Analysis Report, defines the accident scenarios possible from leaking, pressurized, or failed containers.

There is additional information available from sampling of the off-gas system that ventilates the storage tubes and from visual inspections of empty storage tubes that indicates that there has not been a gross failure of the packages. Several storage tubes are known, and others are suspected, to be contaminated from packages that were contaminated when originally stored. There is evidence of limited corrosion and pitting of the carbon steel storage tubes due to atmospheric moisture, but no evidence of condensate or accumulated water in the empty storage tubes. While the containers at the bottom of the storage tubes have not been inspected, a few containers have been removed from the tubes from time to time to allow uses such as extraction of the ^{229}Th that is being used as source material in ongoing clinical trials. No evidence of container degradation has been found and there are no indications of other problems.

3.1.2 Processing Sequence

The Contractor shall process the ^{233}U in a manner that balances the demand for ^{229}Th extraction with obtaining a representative data set on the condition of the material and packages to address DNFSB Recommendation 97-1, according to the Project Management Plan. The processing sequence should consider the relative risks associated with each container as stated in Reference Document #5, Final Oak Ridge

National Laboratory Site Assessment Report on the Storage of ^{233}U. The data set shall describe the condition of the storage containers, including structural integrity, radiological contamination, and container configuration (e. g. dimensions, number of inner containers and materials of construction, and ^{233}U physical form and associated radiation levels).

3.1.3 ^{233}U End Point Specification:

After thorium extraction processing activities have been completed, the ^{233}U material shall be returned to DOE downblended to a product that is equivalent to not more than 0.96 wt % ^{235}U in a mixture of ^{235}U and ^{238}U as identified in Table 2 of ANSI/ANS-8.1-1998. For this evaluation, 0.66 wt % ^{233}U shall be considered equivalent to 1.0 wt % ^{235}U (Isotopic Dilution Requirements for ^{233}U Criticality Safety in Processing and Disposal Facilities, ORNL/TM-13524, November 1997, p. xii, Reference Document #6). Dilution calculations shall consider the amount of ^{233}U and ^{235}U in the original ^{233}U-bearing material and the amount of ^{235}U in the depleted uranium.

DOE will provide the ^{238}U necessary to accomplish the required downblend. The amount of ^{238}U required for downblending is currently estimated to be 255,000 kilograms and can be made available as uranium oxide (UO_3) from the DOE Savannah River Site (SRS). Detailed descriptions of the physical and chemical properties of this material and drum conditions are contained in Reference Document **#?,** Depleted Uranium Trioxide (UO3) Characterization and Storage, 94AB62387P-00F, dated 1995**.** A radiological characterization can be found in Reference Document (#**?, TBD)**. The SRS UO_3 is packaged in standard 55-gal drums approximately 2/3 full that weigh on the order of 1,400 to 1,500 pounds each (however, some individual drums have been noted to weigh as little as 1,100 pounds up to as much as 1,700 pounds) The 1995 characterization report indicates that the vibrated density of the oxide powder is 3.5 g/cc. However, calculated densities of actual drums indicate that average density in the drums is closer to 4.5 g/cc due to packing of the material during drum loading and subsequent handling. Nevertheless, this material still becomes free flowing with minimal effort. The drums are generally rusted and dented and would require overpacking for shipment. This UO_3 is reactor recycled material, and thus has traces of Pu (less than 10 ppb), and minute quantities of other isotopes including: ^{129}I, ^{99}Tc, ^{90}Sr and ^{137}Cs and other transuranics (e.g. Np, Am).

The Contractor shall be responsible for packaging and transportation of the UO_3 to and from the processing location according to applicable DOE and DOT requirements, including all associated costs. The contractor shall coordinate preparation for shipment, and shipment of this material with DOE and the SRS site contractor and meet applicable SRS requirements during these activities. After completion of ^{233}U downbleding , the Contractor shall return any excess UO_3 to DOE in containers suitable for off-site shipment.

3.1.4 End Point Packaging Specification

DOE's objective is to package the downblended material in robust, contact handled packages to ensure safe, long term storage. DOE's most conservative packaging standard for contact handled material is currently contained within the Waste Acceptance Criteria for the Waste Isolation Pilot Plant, (DOE/WIPP-069, Revision 7 with Change Notice 1), Reference Document # 7. Therefore, the Contractor shall package the processed ^{233}U

material in accordance with this standard. Additionally, the contractor shall package the ^{229}Th in packages suitable for offsite transportation in accordance with applicable DOE and Department of Transportation (DOT) requirements specified in Attachment D, List of Applicable Directives.

3.1.5 MSRE Material

There are currently four containers of fresh MSRE fuel (Table 1, Figures A.5, A.6, A.7) and 25 MSRE UF_6 traps (Table 1, line following Figure A.47) in storage in Building 3019A. The four containers of fresh MSRE fuel will be processed and dispositioned in accordance with the DOE approved Project Management Plan. The MSRE UF_6 traps exhibit a high radiation field and are slowly pressurizing. A bounding description for this material is provided below. The Contractor will remove the traps and containers from the Building 3019A storage tubes and prepare them for shipment. The DOE EM contractor will transport this material to ORNL Building 4501 and will process it for conversion to stable U_3O_8. An additional 27 UF_6 traps may require interim storage by the Contractor in Building 3019A prior to conversion in Building 4501. DOE will return the resulting U_3O_8 to Building 3019A for processing, packaging and disposition by the Contractor as part of the ^{233}U inventory.

The Contractor shall maintain the MSRE UF_6 traps and containers in safe storage in Building 3019A, including temperature and pressure monitoring activities, and prepare them for shipment to Building 4501 according to the DOE schedule for processing provided below. After conversion and packaging by the DOE EM contractor, the Contractor shall be responsible for receiving the stabilized ^{233}U oxides in Building 3019A and shall store, process, package and disposition this material with the rest of the Building 3019A ^{233}U inventory. The DOE EM contractor will be responsible for transportation of the MSRE materials to and from Building 3019A in conjunction with conversion of the ^{233}U in the traps to U_30_8. The Contractor shall coordinate these transfers with the DOE ORNL site contractor and the DOE EM contractor. The total amount of this additional MSRE oxide is approximately 40 kilograms.

3.1.5.1 MSRE Material Bounding Description

The MSRE Remediation Project is being conducted by DOE, and executed by its EM contractor, Bechtel-Jacobs, LLC. The 52 NaF traps generated by the remediation project require storage in Building 3019A, prior to conversion of the collected UF_6,, to a stable oxide by the EM contractor in Building 4501. It should be noted, that the process of collecting the gaseous UF_6 has separated the medical isotopes from the uranium. As stated above, these traps are slowly pressurizing due to fluorine generation by radiolysis, and increasing in radiation field. The 26 traps generated to date have a UF_6 composition as follows: 83.9% ^{233}U, 7.5% ^{234}U, 2.6% ^{235}U, 5.9% ^{238}U and approximately 160 ppm ^{232}U. The inventory of each trap and predicted pressure as a function of time is shown in MSRE Trap Pressure Table, Reference Document #8. The surface dose of the NaF traps will increase to approximately 10 rem/hour over the next five years.

3.1.5.2 DOE Schedule for Shipment and Conversion of MSRE Materials

Including extraction of uranium from the MSRE Fuel Drain tanks, the auxiliary charcoal bed cell, and as reactive gas, the MSRE Remediation Project expects to generate approximately 40 kilograms of ^{233}U in the form of UF_6, on 52 NaF traps. The current expected schedule for the remaining NaF traps, beyond the 25 traps now in interim storage in 3019A, is below.

Also reflected in the table below is the expected schedule of shipment of the traps to ORNL Building 4501 for conversion by DOE of the UF_6 to a stable oxide, U_30_8.

Table 2 – Shipment Schedule of MSRE Materials

	Traps generated	Traps shipped
FY01	4	
FY02	3	16
FY03	8	16
FY04	12	16
FY05		4

3.1.6 Material Transportation

Upon completion of the downblending and packaging of the ^{233}U inventory, the Contractor shall deliver the material to DOE's designated storage location on the Oak Ridge Reservation for DOE storage.
The Contractor is responsible for arranging for, and the cost of, transportation to the storage location. If the Contractor will be processing the ^{233}U at a commercial facility instead of Building 3019A, the Contractor is responsible for the cost of additional packaging and handling; DOE will be responsible for furnishing DOE Safe Secured Transports to transport the material to the processing facility. However, the Contractor shall reimburse DOE for associated costs. The Contractor shall adhere to applicable DOE and DOT transportation standards, rules, regulations and requirements as specified in the table below.

Table 3:Transportation Requirements

Special Nuclear Material Category	Shipment Destination	Carrier Type	Applicable Requirement
CAT I and II	On site and offsite	SST	DOE O 461.1: "Packaging and Transfer or Transportation of Materials of National Security Interest" DOE M 461.1-1: "Packaging and Transfer or Transportation of Materials of National Security Interest" 10 CFR 830: "DOE Nuclear Safety Management"
CAT III and IV	On-site only	Common carrier	DOE O 460.1A: "Packaging and Transportation Safety"

			DOE G 460.1-1: "Packaging and Transportation Safety" 10 CFR 830: "DOE Nuclear Safety Management"
CAT III and IV	Offsite	Common carrier	49 CFR 100-180: "USDOT Hazardous Materials Regulations"

3.1.7 Waste Management

The Contractor is responsible for management of wastes generated from the project including waste characterization, manifesting, interim storage and handling. The DOE EM contractor will be responsible for disposition of any wastes resulting from activities in Building 3019A. The Contractor will be required to interface with existing DOE contractors responsible for waste management, satisfying Project Waste Acceptance Criteria and Operations Requirements, Reference Document # 9. The Contractor shall be responsible for all wastes generated at offsite facilities. The Contractor shall develop a waste management plan for this contract that addresses all primary and secondary waste streams as well as waste minimization efforts.

3.1.8 NEPA

DOE will prepare an environmental assessment (EA) per NEPA regulations [10 CFR 1021 Subpart C and 40 CFR 1500 et seq.] and DOE policy ["Recommendations for the Preparation of Environmental Assessments and Environmental Impact Statements", (March 1993)]. DOE has the responsibility for conducting the NEPA review utilizing the information provided by the Contractor.

The Contractor shall attend and, as needed, participate in stakeholder meetings, and provide any additional data necessary, throughout the NEPA review period.

3.2 Beneficial Use of ^{233}U and Daughter Isotopes

The Contractor shall enter into a lease with the Government for existing purified ^{229}Th inventories and additional thorium extracted under this contract. This lease, separate from the contract, will be with the Oak Ridge Operations Office and approved by the Office of Nuclear Energy, Science and Technology's Office of Isotopes for Medicine and Science. An example of the lease is attached to this contract (Section J, Attachment C) for information and identifies the lease terms and conditions, including requirements for the storage and processing of the ^{229}Th source material, requirements for the production, marketing, sales and distribution of ^{225}Ac/^{213}Bi generators for medical research and treatment, and requirements for continuing to supply existing customers.

3.3 Building 3019A Operations

The Contractor shall operate and be responsible for Building 3019A and its associated structures, systems and equipment to ensure safe interim storage of the ^{233}U inventory

prior to disposition, and to support disposition activities. Operations include handling, inspecting, and storing ^{233}U-bearing materials, and facility surveillance and maintenance activities necessary to ensure safety and health of employees and the public, and protection of the environment. In addition, the Contractor shall maintain the necessary systems to supply the following to Building 3019B: (1) electrical power; (2) fire water; (3) routing of fire detection signals; and (4) Laboratory Off-Gas ventilation of Building 3019B hot cells.

The Contractor is responsible for maintaining a comprehensive surveillance and maintenance program to ensure operability of safety-related equipment. The surveillance program shall meet the requirements in the Technical Safety Requirements (TSR), (ORNL/CTD/3019/TSR/Revision 0), Reference Document # 10, to provide for a safe workplace, and to ensure the proper operation of equipment. Additionally, the Contractor shall develop and implement a Radiation Protection Program for Building 3019A operations in accordance with 10 CFR 830 and 10 CFR 835. The Contractor shall continue to use the currently approved Oak Ridge National Laboratory Integrated Safety Management System from the previous contract through a period of transition, Reference Document #11. The maintenance program for the facility shall encompass preventative, corrective, and predictive elements for confinement systems, ventilation systems, fire protection systems, instrumentation, utilities, material handling equipment, and safety significant and safety class systems, structures, and components.

The Contractor may process the ^{233}U inventory in Building 3019A, or propose a commercial facility. Regardless of the material processing location, the Contractor will remain responsible for Building 3019A including operations described herein.

The Contractor shall also be responsible for the government property identified in Attachment B, Section J of the contract. The Contractor shall maintain the property in accordance with the routine/preventative maintenance procedures as included in the Radiochemical Development Facility Scheduled Program Maintenance, Reference Document # 12, and other applicable terms of the contract.

3.3.1 Building 3019A Authorization Agreement

Building 3019A is currently operated in accordance with an approved Authorization Agreement (AA), dated April 1, 2000, Reference Document # 13, which covers the existing storage, transfer, and minimal chemical operations within the facility. The Contractor shall operate and maintain Building 3019A in its current configuration and mode of operation, consistent with the AA. The AA includes the Authorization Basis (AB) as prescribed by applicable safety documentation, DOE orders and standards. The current Facility AB consists of a SAR and TSR and its associated Safety Evaluation Report (SER). The TSR establishes the limiting conditions of operations and the inventory limits for operations are specifically spelled out in Limiting Condition for Operation 3.1.1 on page 3 / 4 1-1. A detailed description of the facility and operable equipment is provided in the approved SAR.

If the Contractor intends to conduct increased material processing activities from the levels currently authorized in the facility AB, activate currently out-of-service equipment, or make any other operational changes within Building 3019A, these changes shall be subject to Safety Evaluations/Unreviewed Safety Question Determinations and other technical reviews required by DOE regulations including DOE requirements for restart of nuclear facilities (DOE O 425.1B). These changes may

require a revision to the AB. Revisions to the AB (e.g. SAR, TSR, or SER) are the responsibility of the Contractor, including cost.

DOE shall review and approve any modification to the facility or mode of operation determined to be an Unreviewed Safety Question before implementation, and revisions to the SAR or TSR

The Contractor shall develop its own AA to replace the existing UT-Battelle AA, and receive DOE approval prior to assuming responsibility for Building 3019A.

3.3.2 Facility Upgrades

The Contractor is responsible for upgrades to Building 3019A and its associated facilities that are necessary to implement its processing strategy.

3.3.3 DNFSB Response Actions

The Contractor shall prepare any necessary technical analysis and documentation to support DOE in responding to the DNFSB. The Contractor will perform all actions necessary to achieve closure to DNFSB recommendations 97-1 and 2000-2, as applicable, according to the Project Management Plan.

3.3.4 Safeguards, Security and Classification

The Contractor shall safeguard the special nuclear material in Building 3019A in accordance with the DOE approved Site Safeguards and Security Plan (SSSP), Reference Document # 14. The Contractor shall maintain and revise the SSSP in accordance with the requirements of the DOE Order 470 series specified in Attachment D. The Contractor shall provide a revised SSSP for DOE approval prior to implementation of the Contractor's operating/processing strategy, if needed.

The protective force services will be provided by DOE through ORO's Safeguards and Security (S&S) contractor. The Contractor shall coordinate with the ORO and the S&S contractor for the provision of these services.

The Contractor is responsible for protecting classified information in accordance with DOE Order M 475.1-1, Identifying Classified Information.

If the Contractor will be processing the ^{233}U at a commercial facility instead of Building 3019A, the Contractor is responsible for safeguarding the ^{233}U inventory in accordance with [TBD].

3.3.5 Material Control and Accountability

The Contractor shall prepare and execute a Nuclear Materials Control and Accountability Plan in accordance with DOE Order 474.1A, "Control and Accountability of Nuclear Materials," and DOE Manuals 474.1-1A, "Manual for Control and Accountability of Nuclear Materials," and 474.1-2, "Nuclear Materials Management and Safeguards Reporting and Data Submission." The contractor shall implement and provide updates to this plan as needed.

3.3.6 Permits and Licenses

The Contractor shall be responsible for execution of activities to satisfy the requirements of permits currently owned by DOE for the ORNL site. Current DOE

permits are listed below. The Contractor will be responsible for any penalties or fines that may be incurred as a result of permit violations, due to operations in Building 3019A. Violations of permit requirements must be reported to DOE and will be reviewed to ensure safe operations. Any other permits or licenses necessary to support Contractor activities within Building 3019A are the responsibility of the Contractor in coordination with DOE. Any permits or licenses required to support offsite activities are the sole responsibility of the Contractor.

Current DOE Permits:

1. Water: State of Tennessee National Pollutant Discharge Elimination System (NPDES) Permit No. TN0002941, dated December 6, 1996, issued by Tennessee Department of Environment and Conservation to U.S. DOE - Oak Ridge National Laboratory. Effluents such as treated wastewater, storm water runoff, cooling water, and condensate are addressed in this permit. Building 3019A is listed as containing 102 drain sources that send wastewaters such as low-level radioactive wastewaters, process wastewaters, domestic wastewater, storm water runoff, cooling water, and condensate via piped collection systems to ORNL treatment facilities or outfalls, depending on the nature of the wastewater.

2. Hazardous Waste: Building 3019A has no RCRA permits, but has RCRA & TSCA-regulated generator areas. Building 3019A has 4 Satellite Accumulation Areas and 2 Used Oil Collection Points.

3. Air: The majority of process source emissions from Building 3019A are discharged through stack 3020. Some emissions are vented through stack 3039. 40 CFR 61, Subpart H monitoring and reporting requirements are applicable to these 3019A emission points. These emission points are designated major sources. Stack monitoring is required. Stack 3020 is not presently permitted, however this stack will be permitted as a Title V source due to potential radionuclide emissions. Stack 3039 is currently permitted by the Tennessee Department of Environment and Conservation (permit number 739974P) and will also be permitted as a Title V source. All other emission points associated with Building 3019A are considered general exhaust, such as room ventilation, bathroom vents, etc. and are exempt from permitting.

3.3.7 Services

The Contractor will be operating Building 3019A and its associated facilities at the ORNL site. Services such as electric power, steam, water, telecommunications, and emergency services are an integral part of the ORNL infrastructure. The Contractor will be required to procure these services. The following table provides the per unit cost for these services:

Table 4: PURCHASE SERVICES

Service	Billing Basis	Cost Basis
Electric Power [1]	Monthly	$65.00 per megawatt hour
Potable, Fire Protection & Process Water [2]	Monthly	$ 1.60 per 1,000 gals

Steam	Monthly	$ ___ per ___
Telephone – Voice line[3]	Monthly	$ 62.50 per month, per line
Telephone – ISDN line[3]	Monthly	$ 76.00 per month, per line
Emergency Services [4]	Monthly	$ ___ per month
Alarm Systems monitoring	To Be Determined	To Be Determined

1. Electric Power includes system maintenance (line crew, motor shop, breaker shop, and fire alarm system maintenance).
2. Potable Fire Protection & Process Water includes sanitary and industrial waste disposal and chilled water supply.
3. Telephone (voice and ISDN lines) services will be provided through the DOE telecommunications contractor.
4. Emergency services include Emergency Fire, Medical, and Ambulance Services and Emergency Response Services.

Other services such as grounds maintenance, ES&H support, surveillance & maintenance, radiation protection, classification, and other technical and non-technical services are available from the ORNL contractor. The Contractor may choose to purchase some of these services and shall coordinate for obtaining these services directly with the ORNL contractor. DOE will not be responsible for delays, or cost impacts to the contract as a result of services purchased from the ORNL contractor.

3.4 Building 3019A Shutdown

The Contractor shall place Building 3019A and its associated facilities in a safe, stable shutdown mode in accordance with the Building 3019A End Point Specification Document dated [TBD], Reference Document # 15. These activities will be conducted consistent with the final Facility Transition Plan and a post – transition Surveillance and Maintenance Plan submitted by the Contractor and approved by DOE. The Contractor shall also provide the Project Completion Records Package as identified in the Building 3019A End Point Specification Doument.

3.5 Options

3.5.1 Material Retained for Future Use

DOE has identified a small portion of the ^{233}U inventory in storage in Building 3019A that will be retained (See Table 6). This material may be released to the Contractor for ^{229}Th extraction if DOE determines that this material is no longer needed.

The options for addressing this material are: 1) the Contractor will remove, package, and load the material for offsite shipment by DOE; and/or 2) the Contractor will process, package, and transport the material with the remaining ^{233}U inventory.

Table 5: Retained Material

Figure	Name	Description	Total U (kg)	U-233 (kg)	U-232 (kg)	U-233 (Ci)	Th-229 (Ci)	Th-229 (g)
A.13 A.14 A.15	ZPR powder packets	U_3O_8 powder in 1645 welded Ni-plated SS packets in 130 tin-plated cans	45.95	45.04	6	432.4	0.86	3.91
A.16	ZPR metal packets	4 SS-clad, Ni-plated U metal plates in 1 tin-plated can	0.57	0.56	5	5.4	0.01	0.06
		Total	**46.52**	**45.60**				**3.97**

4.0 Additional Technical Requirements

4.1 Project Management Plan

The Contractor will manage the contract in accordance with the Project Management Plan approved by DOE. Project management will require integration of complex activities. These activities include: integrated safety management; inventory; characterization; sampling, analysis and processing; ^{229}Th beneficial use; quality assurance; radiation protection; criticality control; security; nuclear materials control and accountability; waste management; emergency management; surveillance and maintenance; facility shutdown; development and maintenance of the safety authorization basis documentation for the building and its associated facilities; work control; transportation; utilities and other services.

4.2 Environment Safety and Health

The Contractor shall perform work in a manner that is protective of workers, the public, and the environment. The Contractor must adhere to applicable environmental, safety, and health (ES&H) laws, regulations and DOE Directives. ES&H requirements are addressed in Sections H and I of the contract.

5.0 References

The below list of documents are incorporated herein by reference:

1. Detailed Can Data List
2. Safety Analysis Report, (ORNL/CTD/3019/SAR/Revision 0)
3. DNFSB Recommendation 97-1, Safe Storage of Uranium-233
4. DNFSB Recommendation 2000-2, Configuration Management Vital Safety Systems
5. Final Oak Ridge National Laboratory Site Assessment Report on the Storage of ^{233}U, (ORNL/TM-1999/86, June 1999)
6. Isotopic Dilution Requirements for ^{233}U Criticality Safety in Processing and Disposal Facilities, ORNL/TM-13524, November 1997

7. Waste Acceptance Criteria for the Waste Isolation Pilot Plant, (DOE/WIPP-069, Revision 7 with Change Notice 1)
8. MSRE Trap Pressure Table
9. Project Waste Acceptance Criteria and Operations Requirements
10. Technical Safety Requirements, (ORNL/CTD/3019/TSR Revision 0)
11. Oak Ridge National Laboratory Integrated Safety Management System
12. Radiochemical Development Facility Scheduled Program Maintenance
13. Authorization Agreement
14. Site Safeguards and Security Plan
15. Building 3019A End Point Specification Document

6.0 Schedule of Deliverables

Table 6: Deliverables

Deliverable Number	Deliverable	Schedule for Submission (calendar days when applicable)	DOE Review and Comment Period (calendar days after receipt)[1]	Acceptance Criteria
D-1	Project Management Plan	With proposal and with any material change	45 days for changes	In accordance with contract requirements
D-2	NEPA Data	With proposal and through NEPA review period	15 days	In accordance with contract requirements
D-3	Copies of permit and license applications/ Related correspondence	NLT 12 months after contract award	None required. For DOE information only	Not applicable
D-4	Copies of issued permits and licenses	As per Permitting and Licensing Plan	None required. For DOE information only	Not applicable
D-5	Waste Management Plan	120 days after contract award	60 days	In accordance with contract requirements
D-6	Integrated Safety Management Plan	120 days after contract award	90 days	In accordance with - Safety Management System Policy - P 450.4 and Clause DEAR 952.223-71 - Line Environment Safety and Health Oversight – P450.5 - Safety Management Functions Responsibilities and Authorities – P411.1 - Integrated Safety Management System Guide – G450.4-1/1A
D-7	Radiation Protection Plan (RPP)	90 days after contract award	60 days	In accordance with: - 10 CFR 835 and - 10 CFR 830
D-8	Site Safeguards and Security Plan (SSSP) (IF Applicable)	120 days after contract award and with any proposed change	90 days	In accordance with: Safeguards and Security Program – DOE Order 470.1
D-9	Nuclear Materials Control	120 days after contract award	30 days	In accordance with DOE Order 5633 and 474

Deliverable Number	Deliverable	Schedule for Submission (calendar days when applicable)	DOE Review and Comment Period (calendar days after receipt)[1]	Acceptance Criteria
	and Accountability Plan			
D-10	Final Facility Transition Plan	With proposal and with any significant change	45 days	In accordance with contract requirements
D-11	Post-Transition Surveillance and Maintenance Plan	With proposal and with any significant change	45 days	In accordance with contract requirements
D-12	Facility Authorization Agreement	NLT 30 days after contract award	15 days	In accordance with DOE Order 411.1 and DOE P 450.4
D-13	Revised Safety Analysis Report (SAR) (If applicable)	As specified in Project Management Plan	120 days	In accordance with Nuclear Safety Analysis Report DOE O 5480.23 and DOE O421.X
D-14	Revised Technical Safety Requirements (TSR) (If applicable)	As specified in Project Management Plan	120 days	In accordance with: DOE O 5480.22 and 423.1
D-15	Downblended Material Delivered to DOE	As specified in the Project Management Plan	Not applicable	In accordance with contract requirements
D-16	Shutdown of Building 3019A	As specified in the Final Facility Transition Plan	Not applicable	In accordance with contract requirements
D-17	Extracted Thorium	As specified in the Project Management Plan	Not applicable	In accordance with contract requirements
D-18	Project Status Reports and Review Meetings	Monthly through project completion	Not applicable	In accordance with contract requirements
D-19	Shutdown Project Completion Records Package	As specified in the Final Facility Transition Plan	Not applicable	In accordance with contract requirements

[1] DOE Approval 14 calendar days after satisfactory comment resolution

7.0 Glossary of Acronyms and Abbreviations

^{213}Bi	Bismuth-213 isotope
^{229}Th	Thorium-229 isotope
^{232}U	Uranium-232 isotope
^{233}U	Uranium-233 isotope
^{234}U	Uranium-234 isotope
^{235}U	Uranium-235 isotope
^{238}U	Uranium-238 isotope
3019A	Building 3019A at the Oak Ridge National Laboratory and all of its support facilities. These support facilities include: Building 3100 - Storage Vault Building 3091 – Filter House Building 3108 – Filter House Building 3121 – Filter House Building 3136 – Mockup and Storage Building Building 3123 – Standby Power Generator Building 3131 – Standby Power Generator Building 3146 – Standby Power Generator Building 3020 – Stack Building 3001 - 2nd floor changehouse
AA	Authorization Agreement
AB	Authorization Basis
ADU	Ammonium Diuranate
Al	aluminum
ANL	Argonne National Laboratory
CAT	category
CFR	Code of Federal Regulations
cm^2	square centimeters
CTD	Chemical Technology Division
DNFSB	Defense Nuclear Facilities Safety Board
DOE	Department of Energy
DOT	Department of Transportation
dpm	disintegrations per minute
EA	Environmental Assessment
ES&H	Environment, Safety and Health
EM	DOE Office for Environmental Management
FY	fiscal year
gals	gallons
HEPA	high efficiency particulate air filters
ISDN	Integrated Services Digital Network
LANL	Los Alamos National Laboratory

LLC	limited liability corporation
LLLW	Low Level Liquid Waste System
LLSW	low level solid wastes
MSRE	Molten Salt Reactor Experiment
ORO	Oak Ridge Operations
OSHA	Occupational Safety and Health Act
NaF	sodium fluoride
NEPA	National Environmental Policy Act
Ni	nickel
ORNL	Oak Ridge National Laboratory
PCB	polychlorinated biphenyl
ppm	parts per million
Radiochemical Development Facility	Building 3019A
RCRA	Resource Conservation and Recovery Act
RDF	Radiochemical Development Facility (Building 3019A)
S&S	Safeguards and Security
SAR	Safety Analysis Report
Savannah River	Savannah River Plant, Aiken, South Carolina
SS	stainless steel
SSSP	Site Safeguards and Security Plan
SST	Safe Secured Transports
TCSA	Toxic Substances Control Act
TSD	Transportation Safeguards Division
TSR	Technical Safety Requirements
U	uranium
U_3O_8	uranium oxide
UF_4	uranium tetrafluoride
UF_6	uranium hexafluoride
UO_2	uranium dioxide
UO_3	uranium trioxide
USDOT	United States Department of Transportation
ZPR	Zero Power Reactor

[End of Clause]

C.2 ORO C20 REPORTS (MAY 1997)

Reports shall be prepared and submitted in accordance with Section J, Attachment A, Reporting Requirements, the clause entitled "Uniform Reporting System," and other clauses in the contract which specify reporting requirements.

[End of Clause]